Before the
Federal Communications Commission
Washington, D.C. 20554

In the matter of	)	
	)	
Establishment of an Interference Temperature	)	
Metric to Quantify and Manage Interference and	)	ET Docket No. 03-237
to Expand Available Unlicensed Operation in	)	
Certain Fixed, Mobile and Satellite Frequency	)	
Bands	)	

COMMENTS OF NOKIA INC.

Introduction

Nokia Inc. ("Nokia") submits these comments in response to the *Notice of Inquiry and Notice of Proposed Rulemaking*[1] in the above-captioned proceeding. Nokia is the world leader in mobile communications. The company is the leading supplier of mobile phones and a leading supplier of mobile, fixed broadband and IP networks. Nokia is a broadly held company with listings on six stock exchanges.

Nokia applauds the efforts of the Federal Communications Commission ("Commission") to review and update current spectrum management policy with the goals of improving interference management and increasing access to spectrum. Nokia agrees that the "dramatic increases in the overall demand for spectrum based services, rapid technical advances in radio systems, in particular the introduction of various advanced modulation techniques, the increased use of spectrum for mobile services, and the need for increased access to the limited supply of spectrum in recent years are straining the effectiveness of the Commission's longstanding spectrum policies in dealing with some allocations and applications." This proceeding represents a forward-looking effort to tackle the difficult policy issues the Commission faces and explore creative solutions to these challenges.

[1] *Establishment of an Interference Temperature Metric to Quantify and Manage Interference and to Expand Available Unlicensed Operation in Certain Fixed, Mobile and Satellite Frequency Bands*, ET Docket No. 03-237, (rel. November 28. 2003) (NOI and NPRM).

There is clearly a need to examine whether "unrealized opportunities exist for unlicensed low-power users to access spectrum"[2], but increased access to spectrum for unlicensed devices must be carefully balanced against the impact of new policies on incumbent licensed services. Any new interference management regime should provide equal or greater certainty to both unlicensed and licensed users in terms of interference than current policies. The proposed interference temperature concepts in this proceeding raise many questions and uncertainties for both licensed and unlicensed operations.

The technical challenges of implementing the interference temperature concept may lead to increased cost and decreased functionality for both licensed and unlicensed equipment. While goals such as increased spectrum efficiency and greater access to spectrum are laudable, the Commission should not lose sight of its primary mission to "ensure that the American people have available – at reasonable cost and without discrimination – rapid, efficient, nation- and world-wide communication service"[3]. The promised benefits of new technologies must be balanced against the impact those technologies have on consumer needs, such as price, size and power consumption of equipment and quality and reliability of service.

Nokia urges the Commission to avoid basing current regulations on potential future technological advancements. Technology alone should not be a panacea for good spectrum management. In particular, spectrum policy should not be based on technologies that are not market-ready until the costs and benefits of these technologies are better understood. These benefits and costs are more apparent after real-world deployment has reached a mass-market level.

Discussion

The interference temperature concept as proposed in this proceeding presents several challenges for licensed and unlicensed equipment. The Commission proposes several different methods for implementing a system that "would be needed to measure the interference temperature in the band and communicate that information to devices subject to the limit, and a response process that would also be needed to restrict the operation of devices so as to maintain the interference temperature at or below the limit."[4] Nokia believes that any such system should be

[2] *Id*, ¶9
[3] *Strategic Plan FY 2003-FY 2008*, Federal Communications Commission, (rel. October 1, 2002), p.4
[4] See *NOI and NPRM*, ¶11

simultaneously effective, simple and inexpensive for both unlicensed and licensed systems to implement. Below we discuss the benefits and costs of each method proposed by the Commission.

Under the first scenario, the "entire process would take place within an individual device"[5]. This scenario has the benefit of being the simplest and, in theory, the least costly to implement. It is however the least accurate as the device's own contribution to the resulting interference temperature can only be estimated in a rudimentary fashion. Such a method would likely not be sufficiently accurate to ensure compliance with interference temperature limits without additional regulation of transmission power. Additionally, the cost of building unlicensed devices that are capable of this type of measurement and response system is likely to raise the cost of this equipment considerably. Given that many of these unlicensed devices are designed as relatively low-cost, mass-market communications devices, adding expensive radio components to the overall design may have the unintended effect of discouraging the wide deployment of unlicensed devices. The relatively small benefits of implementing this scenario seem to be outweighed by the costs of more expensive and complex unlicensed devices and a choice between greater uncertainty for licensed devices or greater regulation of unlicensed devices.

The second approach to interference temperature "would be for the receive sites of a licensed service to measure the temperature and communicate those measurements to a central site, where the interference temperature profile for a region would be computed. A message could then be broadcast indicating the temperature values over that region and perhaps whether devices would or could not transmit on particular frequencies."[6] A third approach "might be to establish a grid of monitoring stations that would continuously examine the RF energy levels in specified bands, process that data to derive interference temperatures, and then broadcast that data to subject transmitters on a dedicated frequency, again perhaps with instructions [on] how to respond."[7] These two approaches provide better protection than the first method in terms of protecting against exceeding the interference temperature limit by allowing unlicensed devices to respond to additional interference with transmission power control.

However, both of these approaches would be so costly as to be impractical. The radio communication required for transferring and broadcasting interference temperature measurement results is likely to lower the overall efficiency

[5] *Id*, ¶11
[6] *Id*, ¶11
[7] *Id*, ¶12

of the system considerably and add to the cost of devices. In the case of the second approach, much of this increased cost is born by the licensed systems which must upgrade their receive sites when unlicensed devices are likely to benefit more. This would seem to discourage investment by licensed services. It would also result in greater cost and complexity for unlicensed devices. In the case of the latter approach, the creation of a network of entirely separate monitoring sites creates a tremendously costly and complex system that seems to far outweigh any benefits of the scheme. The questions of who should implement and finance this scheme highlight the infeasibility of such a system. In all three cases, the issue of enforcement does not seem to be adequately addressed to warrant the increased equipment costs.

Under any of these scenarios, interference from unlicensed devices --- even a moderate rise in the noise floor –is expected to have a negative impact on licensed services in terms of network coverage, capacity, power consumption by mobile devices (as a result of increased transmission power). This is particularly true for today's existing "second-generation" and "third-generation" mobile cellular systems, although the same general theoretical principles apply to other radio systems. Cellular networks tend to be more interference sensitive that other systems – such as fixed point-to-point or broadcasting -- due to their wide coverage area and minimal interference protection from omni-directional antennas. At the same time, different cellular system standards respond differently in terms of network coverage and service level to the presence of additional interference. This makes setting interference limits that adequately protect a variety of systems in one band difficult. These factors make mobile bands particularly poorly suited for the introduction of interference temperature as an interference management regime.

Summary

While the interference temperature concept is a creative approach to interference management, the concept raises several questions and concerns. The proposed regime is likely to raise the costs for and place significant design challenges on equipment for both unlicensed devices – which depend on low costs and lack of complexity for market success – and licensed systems if these are made responsible for monitoring and communicating interference temperature. At the same time, this interference management approach creates greater interference from unlicensed devices into licensed systems – resulting in reduced system performance. This is particularly true for terrestrial mobile systems like today's Personal Communications Services ("PCS") and Advanced Wireless

Services. The proposed regime does not provide sufficient assurance that enforcement mechanisms will address this increased interference when it exceeds established limits nor does it adequately explain how appropriate interference limits would be set that would protect incumbent services. At this time, the costs of such a scheme appear to far outweigh the benefits.

The proposed interference management approach represents a radical change from current practice, based in part of the possibilities of future or immature technologies. Until we better understand the capabilities – and challenges – of these technologies, the Commission should avoid basing current policy on future unknowns.

Nokia believes this proceeding is a valuable exercise in examining the challenges of interference management in today's environment and exploring various alternatives for addressing these issues. We commend the Commission for its efforts in this area. We respectfully ask that the Commission take into consideration our views expressed here on this proceeding.